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Damage Detection Using High Order Longitudinal Guided Waves in the Anchorage Zone of Stayed-Cable

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High order longitudinal guided waves (HOLGW) are studied for the damage detection in the anchorage zone of stayed cable through the theoretical analysis, numerical simulation and experimental validation. First, based on the theory of elastic wave propagation in cylinder, the dispersion curves of longitudinal modes were obtained and calculated analytically and the high-frequency such as 5MHz corresponding to the higher order longitudinal guided wave modes are identified for the damage detection. Then, the ultrasonic guided waves propagating in a steel wire with or without defects were simulated by using the finite element method and the effects of defect depth and length on the reflection coefficient are studied. Finally, the free wires and a tested cable were studied experimentally. The results show that the finite element method is able to model the high-order guided wave propagation in the steel wire. The agreement between the experiment and theory has demonstrated that the HOLGW is a potential candidate for the damage detection in anchorage zones of stayed-cables.

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